

AMMENDMENTS TO THE CLAIMS

Claims 1 - 55 were pending at the time the Office Action was issued.

Claims 1, 13, 20, 23, 30, 32, 35, 41, and 48 have been amended.

Claims 1 – 55 remain pending.

1. (Currently Amended) A method for fast channel changing in a multicast video distribution architecture, the method comprising:

detecting a channel change request that indicates a requested channel, the requested channel corresponding to a multicast group; and

transmitting a retained intra frame and no dependent frames for the requested channel as a unicast communication.

2. (Original) The method as recited in claim 1, further comprising:

caching at least one previous intra frame for each channel of a plurality of channels as a set of cached intra frames; and

retrieving, responsive to the detecting, the retained intra frame for the requested channel from the set of cached intra frames, the retained intra frame comprising a previous intra frame.

3. (Original) The method as recited in claim 1, wherein:

the detecting comprises detecting the channel change request from a particular client; and

the transmitting comprises transmitting the retained intra frame to the particular client.

4. **(Original)** The method as recited in claim 1, further comprising:
synchronizing a multicast joining operation to the multicast group
corresponding to the requested channel with regard to a next decodable frame of
the requested channel.

5. **(Original)** The method as recited in claim 4, further comprising:
buffering a video stream portion;
wherein the synchronizing comprises determining when the next decodable
frame is present within the buffered video stream portion.

6. **(Original)** The method as recited in claim 4, further comprising:
buffering a video stream portion;
wherein the synchronizing comprises determining when the retained intra
frame reaches a joining time of the buffered video stream portion.

7. **(Original)** The method as recited in claim 4, further comprising:
issuing a join command responsive to the synchronizing.

8. **(Original)** The method as recited in claim 7, wherein the issuing
comprises:

transmitting a join instruction communication to a client that made the
channel change request, the join instruction communication stipulating a time at
which the client is to transmit a join message to a replication point.

9. **(Original)** The method as recited in claim 7, wherein the issuing comprises:

transmitting a join message to a replication point.

10. **(Original)** The method as recited in claim 1, further comprising:
caching at least one previous intra frame for each channel of a plurality of channels as a set of cached intra frames;

retrieving, responsive to the detecting, the retained intra frame for the requested channel from the set of cached intra frames, the retained intra frame comprising a previous intra frame;

buffering a video stream portion;

synchronizing a multicast joining operation to the multicast group corresponding to the requested channel based, at least partially, on whether a next intra frame is present within the buffered video stream portion; and

issuing a join command responsive to the synchronizing.

11. **(Original)** The method as recited in claim 1, further comprising:
buffering a video stream portion;
buffering at least two intra frames for each channel of a plurality of channels to produce buffered intra frames;

retrieving, responsive to the detecting, the retained intra frame for the requested channel from the buffered intra frames with regard to a joining time of the buffered video stream portion;

synchronizing a multicast joining operation to the multicast group corresponding to the requested channel based, at least partially, on whether a next decodable frame is outside the joining time; and

issuing a join command responsive to the synchronizing.

12. (Original) One or more processor-accessible media comprising processor-executable instructions that, when executed, direct an apparatus to perform the method as recited in claim 1.

13. (Currently Amended) A channel change server comprising:
cached intra frames for a plurality of video streams, each respective video stream of the plurality of video streams associated with a respective channel of a plurality of channels;

a channel change request detector that is capable of detecting channel change requests from individual clients of a plurality of clients; and

a channel change request handler that is configured to respond to a detected channel change request from a particular client of the plurality of clients by extracting a most recent intra frame of a video stream associated with a requested channel from the cached intra frames and by transmitting the extracted most recent intra frame and no dependent frames to the particular client using a unicast communication;

wherein the channel change server is associated with multicast video distribution of the plurality of video streams.

14. (Original) The channel change server as recited in claim 13, further comprising:

an intra frame cacher that is adapted to extract intra frames from the plurality of video streams and to cache at least a most recent intra frame for each video stream of the plurality of video streams.

15. (Original) The channel change server as recited in claim 13, further comprising:

a join command issuer that is adapted to send a join message to a replication point to cause the replication point to join the particular client to a multicast group corresponding to the requested channel.

16. (Original) The channel change server as recited in claim 13, further comprising:

a join command issuer that is adapted to send a join instruction message to the particular client, the join instruction message stipulating an appointed time at which the particular client is to transmit a join message to a replication point.

17. (Original) The channel change server as recited in claim 13, further comprising:

a synchronization determiner that is adapted to synchronize a multicast joining operation for the particular client to a multicast group corresponding to the requested channel with regard to a next intra frame of the video stream associated with the requested channel.

18. (Original) The channel change server as recited in claim 17, wherein the synchronization determiner is further adapted to synchronize the multicast joining operation for the particular client to the multicast group corresponding to the requested channel using a quasi-predicted time of the next intra frame of the video stream associated with the requested channel.

19. (Original) The channel change server as recited in claim 17, further comprising:

a time-delayed buffered portion of the video stream that is associated with the requested channel;

wherein the synchronization determiner is further adapted to synchronize the multicast joining operation for the particular client to the multicast group corresponding to the requested channel with regard to the time-delayed buffered portion of the video stream that is associated with the requested channel.

20. (Currently Amended) The channel change server as recited in claim 19, wherein a size of the time-delayed buffered portion corresponds to a ~~likely or possible~~ time period consumed when joining the particular client to the multicast group corresponding to the requested channel.

21. (Original) The channel change server as recited in claim 19, wherein the synchronization determiner is further adapted to determine that a join command is to be issued when the synchronization determiner ascertains that the

next intra frame is present within the time-delayed buffered portion of the video stream that is associated with the requested channel.

22. (Original) The channel change server as recited in claim 19, wherein the synchronization determiner is further adapted to prompt issuance of a join command as soon as the next intra frame is ascertained to be present within the time-delayed buffered portion of the video stream that is associated with the requested channel even if the extracted most recent intra frame of the video stream associated with the requested channel has not been fully delivered to the particular client using the unicast communication.

23. (Currently Amended) A channel change server comprising:
retained intra frames for a plurality of video streams, each respective video stream of the plurality of video streams associated with a respective channel of a plurality of channels;

a channel change request detector that is capable of detecting channel change requests from individual clients of a plurality of clients; and

a channel change request handler that is configured to respond to a detected channel change request from a particular client of the plurality of clients by extracting a retained intra frame of a video stream associated with a requested channel from the retained intra frames and by transmitting the extracted retained intra frame and no dependent frames to the particular client using a unicast communication;

wherein the channel change server is associated with multicast video

distribution of the plurality of video streams.

24. (Original) The channel change server as recited in claim 23, further comprising:

a video stream bufferer that is adapted to buffer each video stream of the plurality of video streams to create a plurality of respective buffered portions.

25. (Original) The channel change server as recited in claim 23, further comprising:

a join command issuer that is adapted to send a join message to a replication point to cause the replication point to join the particular client to a multicast group corresponding to the requested channel.

26. (Original) The channel change server as recited in claim 23, further comprising:

a join command issuer that is adapted to send a join instruction message to the particular client, the join instruction message stipulating an appointed time at which the particular client is to transmit a join message to a replication point.

27. (Original) The channel change server as recited in claim 23, further comprising:

a synchronization determiner that is adapted to synchronize a multicast joining operation for the particular client to a multicast group corresponding to the requested channel with regard to a next decodable frame of the video stream

associated with the requested channel.

28. (Original) The channel change server as recited in claim 27, wherein the synchronization determiner is further adapted to synchronize the multicast joining operation for the particular client to the multicast group corresponding to the requested channel using a quasi-predicted time of the next decodable frame of the video stream associated with the requested channel.

29. (Original) The channel change server as recited in claim 27, further comprising:

a time-delayed buffered portion of the video stream that is associated with the requested channel;

wherein the synchronization determiner is further adapted to synchronize the multicast joining operation for the particular client to the multicast group corresponding to the requested channel with regard to the time-delayed buffered portion of the video stream that is associated with the requested channel.

30. (Currently Amended) The channel change server as recited in claim 29, wherein a size of the time-delayed buffered portion corresponds to a ~~likely or possible~~ time period consumed when joining the particular client to the multicast group corresponding to the requested channel.

31. (Original) The channel change server as recited in claim 29, wherein a size of the time-delayed buffered portion corresponds to a combination

of a multicast joining time and an intra frame interval duration.

32. (Currently Amended) The channel change server as recited in claim 29, wherein a joining time of the time-delayed buffered portion corresponds to a ~~likely or possible~~ time period consumed when joining the particular client to the multicast group corresponding to the requested channel.

33. (Original) The channel change server as recited in claim 29, wherein the synchronization determiner is further adapted to determine that a join command is to be issued when the synchronization determiner ascertains that the next decodable frame is proximate to a joining time of the time-delayed buffered portion of the video stream that is associated with the requested channel.

34. (Original) The channel change server as recited in claim 29, wherein the synchronization determiner is further adapted to prompt issuance of a join command as soon as the next decodable frame is ascertained to be entering a joining time of the time-delayed buffered portion of the video stream that is associated with the requested channel even if the extracted retained intra frame of the video stream associated with the requested channel has not been fully delivered to the particular client using the unicast communication.

35. (Currently Amended) An arrangement for channel changing, comprising:

retention means for retaining at least one intra frame for each video stream

of a plurality of video streams, each respective video stream associated with a respective channel of a plurality of channels;

detection means for detecting a channel change request from a client that indicates a requested channel, the channel change request from the client signifying a demand to switch from a first multicast group to a second multicast group that corresponds to the requested channel; and

handler means for handling the channel change request by transmitting a retained intra frame and no dependent frames to the client via a unicast communication, the retained intra frame retained by the retention means from a respective video stream that is associated with the requested channel.

36. (Original) The arrangement as recited in claim 35, further comprising:

buffer means for buffering each respective video stream of the plurality of video streams to establish a respective buffered portion for each respective video stream; and

synchronization means for synchronizing a joining of the client to the second multicast group (i) with reference to a respective buffered portion for the respective video stream that is associated with the requested channel and (ii) with regard to a next decodable frame of the respective video stream that is associated with the requested channel.

37. (Original) The arrangement as recited in claim 36, further comprising:

issuance means for issuing a join command responsive to the synchronization means.

38. (Original) The arrangement as recited in claim 35, wherein the retention means comprises at least one of (i) buffering means for buffering the at least one intra frame for each video stream of the plurality of video streams and (ii) caching means for caching at least one intra frame for each video stream of the plurality of video streams.

39. (Original) The arrangement as recited in claim 35, wherein the arrangement comprises at least one server.

40. (Original) The arrangement as recited in claim 35, wherein the arrangement comprises one or more processor-accessible media.

41. (Currently Amended) A server that is configured to retain at least one independent frame for each video channel of a plurality of video channels that are being distributed using multicast communications and that is adapted to respond to channel change requests from clients by transmitting the retained at least one independent frame and no dependent frames of a requested video channel to a requesting client using a unicast communication.

42. (Original) The server as recited in claim 41, wherein the server is capable of multicasting the plurality of video channels to the clients.

43. (Original) The server as recited in claim 41, wherein the server is capable of synchronizing a multicast joining operation for the requesting client with regard to a next decodable frame of the requested video channel.

44. (Original) The server as recited in claim 43, wherein the next decodable frame of the requested video channel comprises a next independent frame.

45. (Original) The server as recited in claim 43, wherein the next decodable frame of the requested video channel comprises a next dependent frame.

46. (Original) The server as recited in claim 41, wherein the server is capable of synchronizing a multicast joining operation for the requesting client with regard to a next decodable frame of the requested video channel; and wherein the server is further adapted to refrain from transmitting the retained at least one independent frame of the requested video channel to the requesting client if transmission of the retained at least one independent frame jeopardizes timely reception of the next decodable frame of the requested video channel.

47. (Original) The server as recited in claim 41, wherein the server is further adapted to issue a join command irrespective of a complete or an incomplete delivery to the requesting client of the retained at least one

independent frame of the requested video channel.

48. (Currently Amended) A system comprising:
at least one processor; and
one or more media including processor-executable instructions that are capable of being executed by the at least one processor, the processor-executable instructions adapted to direct the system to perform actions comprising:
multicasting a plurality of channels;
retaining at least one intra frame for each channel of the plurality of channels; and
transmitting a retained intra frame and no dependent frames for a requested channel as a unicast communication responsive to a channel change request.

49. (Original) The system as recited in claim 48, wherein the system comprises a video provider and a channel change server.

50. (Original) The system as recited in claim 48, wherein the system comprises a video provider and a channel change server that are co-located.

51. (Original) The system as recited in claim 48, wherein the system comprises a channel change server that receives the plurality of channels from a video provider; and wherein the channel change server performs the action of multicasting the plurality of channels.

52. (Original) The system as recited in claim 48, wherein the processor-executable instructions are adapted to cause the system to perform a further action comprising:

synchronizing a multicast joining operation to a multicast group corresponding to the requested channel with regard to a next decodable frame of the requested channel.

53. (Original) The system as recited in claim 52, wherein the processor-executable instructions are adapted to cause the system to perform a further action comprising:

buffering a video stream portion of a video stream that is associated with the requested channel;

wherein the action of synchronizing comprises an action of determining when the next decodable frame is present within the buffered video stream portion of the video stream that is associated with the requested channel, the next decodable frame comprising a next intra frame.

54. (Original) The system as recited in claim 52, wherein the processor-executable instructions are adapted to cause the system to perform a further action comprising:

buffering a video stream portion of a video stream, which is associated with the requested channel, to a length that at least equals a sum of a multicast joining time and an intra frame interval duration;

wherein the action of synchronizing comprises an action of determining

when the next decodable frame is entering the multicast joining time part of the buffered video stream portion of the video stream, the next decodable frame comprising a next non-intra frame.

55. (Original) The system as recited in claim 52, wherein the processor-executable instructions are adapted to cause the system to perform a further action comprising:

issuing a join command responsive to the synchronizing.